Fletcher, Heald & Hildreth, P.L.C.
1300 North 17th Street 11th floor
Arlington VA 22209
703-812-0400 (voice)
703-812-0486 (fax)

MITCHELL LAZARUS
703-812-0440
LAZARUS@FHHLAW.COM

May 30, 2001

Ms. Magalie Salas, Secretary
Federal Communications Commission
445 12th Street SW
Washington DC 20554

Re: ET Docket No.98-153 -- Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems

Dear Ms. Salas:

Pursuant to Section 1.1206(a)(2) of the Commission's Rules, on behalf of XtremeSpectrum, Inc., I am filing the original and one copy of this letter to report an oral ex parte communication in the above-referenced proceeding.

Yesterday, Martin Rofheart, John McCorkle, and Matt Welborn of XtremeSpectrum, Inc. and I met with Julius P. Knapp (by teleconference), Karen Rackley, and John A. Reed of the Commission staff. During the meeting, we reiterated the views expressed in XtremeSpectrum's pleadings. A copy of our presentation outline is attached.

Kindly date-stamp and return the extra copy of this letter.

If there are any questions about this filing, please call me at the number above.

Respectfully submitted,

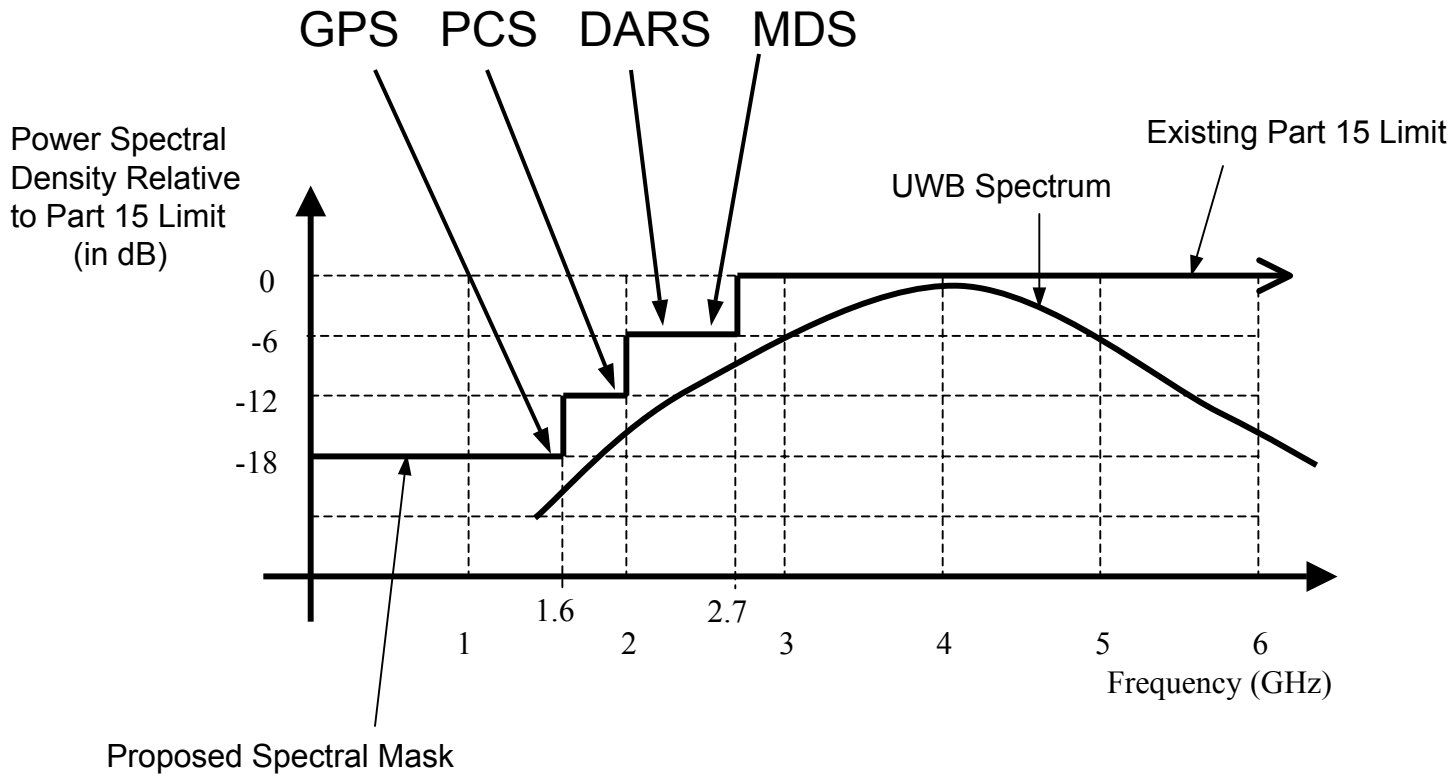
Mitchell Lazarus
Counsel for XtremeSpectrum, Inc.

cc: Meeting participants

Outline

- **Summary of XSI Proposed Changes to NPRM**
  - Emission mask
  - Indoor Usage
  - Test for spectral lines in GPS band
  - Peak to Average Test
- **Summary of results on Aggregation**
- **Discussion of how proposed changes solve issues raised by:**
  - GPS
  - PCS
  - DARS
  - NTIA
    - Radar
    - Satellite
    - Airborne
- **Q & A Discussion of items of interest to FCC.**

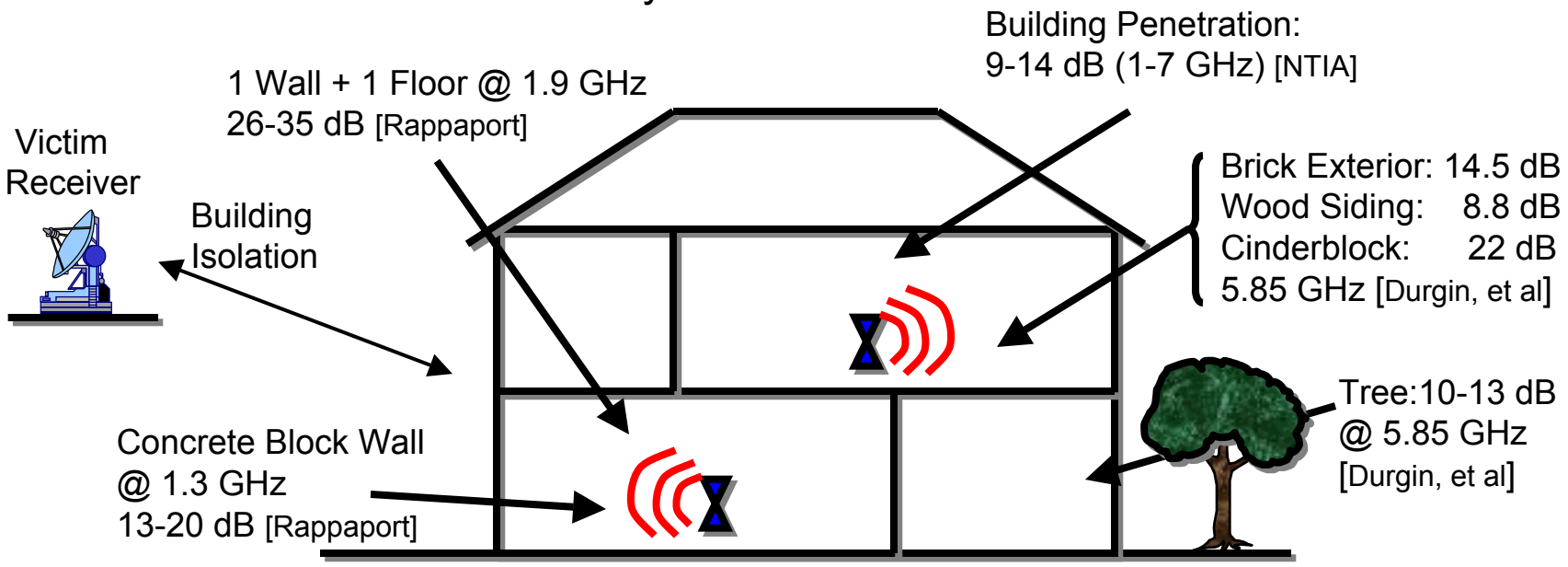
Proposed Spectral Emission Mask



- **Establish interim rules**
- **Establish technology-neutral rules**

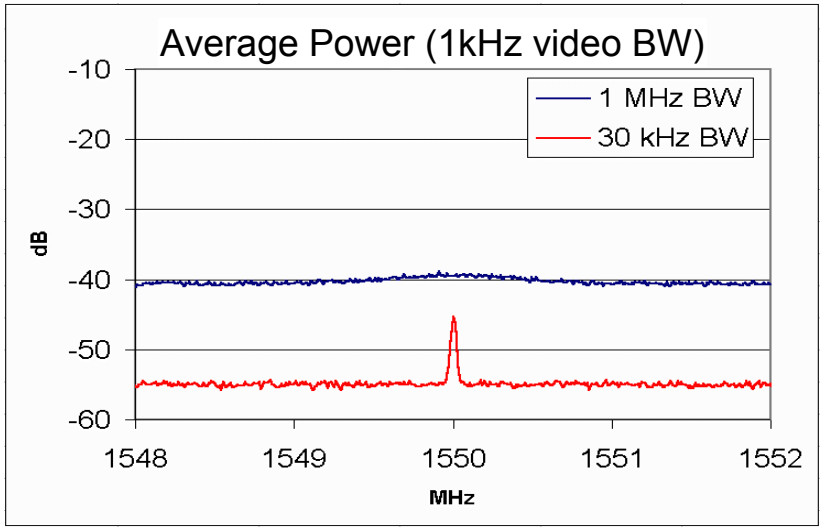
Indoor Usage Restriction

- **Restriction to indoors provides isolation from victim systems**
  - No systems with a UWB device on every other telephone pole.
- **NTIA estimated through-the-wall loss of 9-14 dB but**
  - Estimate is low based on measurements reported in literature.
  - Was not included in analysis



GPS Band Spectral Line Test

- XSI proposes an 30 kHz RBW (resolution bandwidth) test to prevent interference to particular GPS receivers
- This test is 15 dB more sensitive to spectral lines than to noise-like interference.
- This test effectively provides a total of 33 dB extra (over Class-B) protection for GPS against signals with spectral lines at critical frequencies in the GPS L1 band.



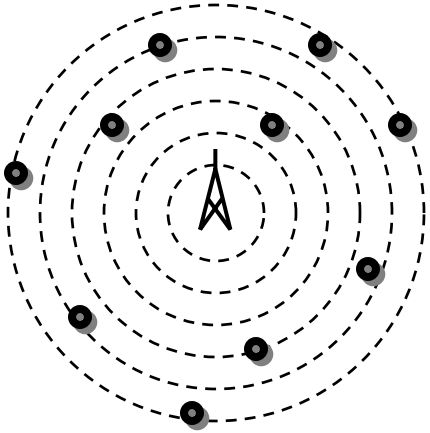
Peak to Average Test

- **The proposed test to limit the ratio of peak power to average power in paragraphs 42 and 43 of the NPRM does not completely accomplish this purpose.**
  - Used ratio of power at two different bandwidths
  - fooled by a tone since a tone looks the same in either bandwidth
- **We suggest, as per the NPRM (¶44), that the FCC consider requirements that use time domain and frequency domain measurements of UWB signals to measure the ratio of peak power to average power.**
  - Use a spectrum analyzer to find the upper and lower –10dB frequencies and spectral peaks
  - Use a high bandwidth sampling oscilloscope to find the true peak-to-peak signal voltage (taking into account the o'scope rise time given the signal bandwidth)
  - Use a power meter to measure the total average power
  - Ratio the Power in peak-to-peak to the average power

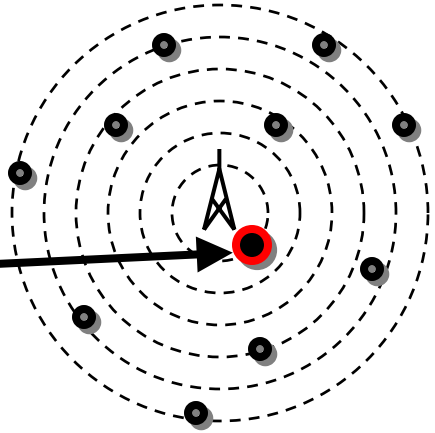
Aggregation Results

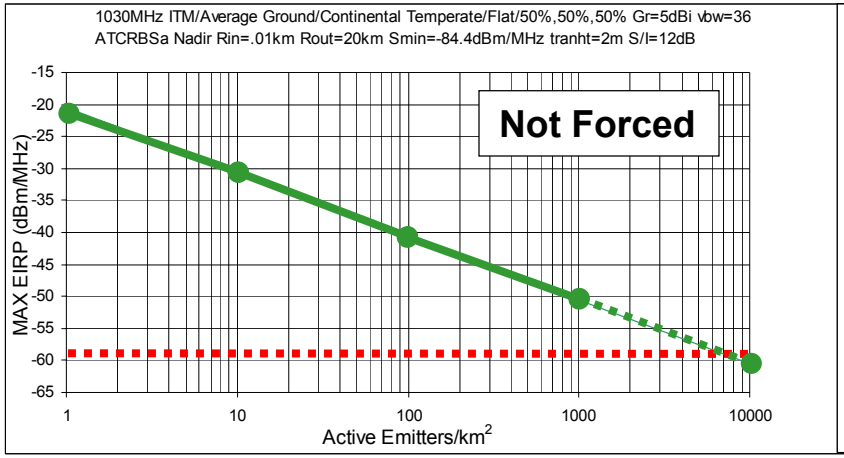
- **For all practical purposes, only the closest transmitters affect the received signal level. So single-emitter analysis can be used to understand interference potential.**
  - Analysis in the NTIA reports, along with XSI's and others, resolve concerns about cumulative interference effects.
- **UWB does not raise the noise floor as some have claimed**
- **Thousands of UWB devices can exist in a small area because**
  - Self limiting:
    - Power and duty cycle must go down as physical densities go up.
  - Only a few will actually transmit simultaneously
    - Single shared channel – TDD/TDMA
  - Real-world attenuation and random reflections cause energy to dissipate
- **Next slide illustrates NTIA's model**

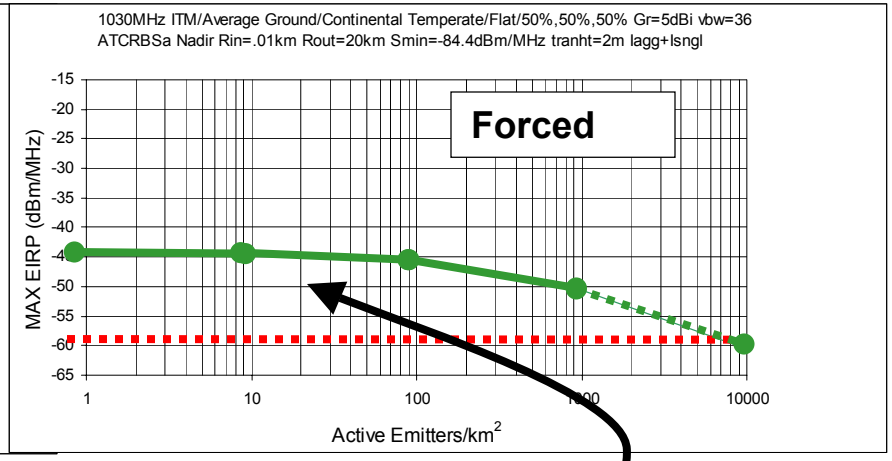
UWBRings Model
Demonstrates only nearest radiators matter



- NTIA's UWBRings Model is based on uniformly distributed UWB emitters.
- Additional whole emitter added to first ring to force results to match with single-emitter analysis at reasonable densities







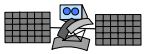
Forcing whole emitter on closest ring flattens curve

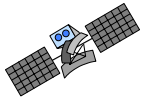
(only 2 dB rise in interference power for 100x increase in UWB density)

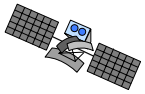
GPS Interference Testing

The study results demonstrate that UWB devices using XSI's proposed changes to the NPRM will not lead to harmful interference to GPS

- **7 Reports issued on UWB/GPS testing and analysis**
  - Even the most severe test possible shows no harmful interference with the changes proposed by XSI
    - Testing used worst-case UWB signaling with large spectral lines.
    - The UWB device parameters were adjusted to find modes that interfered the most.
    - GPS devices were selected that were most sensitive to the interference.
    - UWB antenna pattern was not factored into analysis, but was always assumed to be pointing at the victim receiver, even for moving receivers.
- **Key Discoveries**
  - C/A code-tracking GPS receivers are particularly vulnerable to critical tones that are associated with spectral lines in the C/A codes.
  - Sensitivity to tones was found to be 15 dB greater than to noise.
- **Impact**
  - XSI proposed a measurement procedure to detect and limit spectral lines in the GPS bands.





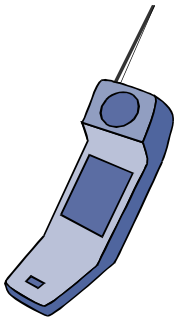


GPS Detail

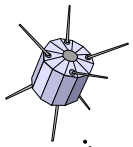
- **There were 74 cases in the NTIA GPS study**
- **Results imply 88% of GPS systems experienced interference.**
- **Results imply 93% of airborne systems experienced interference.**

- **Signals used were:**
  - 12 dB more power than proposed in the NPRM
  - 18 dB more that in XSI's proposed limit to make early rules easier.
- **XSI proposed outdoor usage restrictions.**
  - 66% of studied cases were outdoor emitters and 82% had multiple emitters
  - 73% of aircraft studied cases were outdoor emitters and all had multiple emitter cases
- **With the proposed limitations, for airborne cases:**
  - At the NPRM level NO cases were affected.
- **With the proposed limitations, for all cases:**
  - 15% are affected at NPRM levels
  - 4% are affected at XSI's proposed levels without spectral-line test
    - All of these cases produce line spectra that XSI's proposed test detects.
  - **<u>0 % with XSI proposed changes</u>**
    - **<u>Even with multiple emitters</u>**

The tests and analysis demonstrate that UWB devices using rules as proposed in NPRM will not lead to harmful interference to PCS

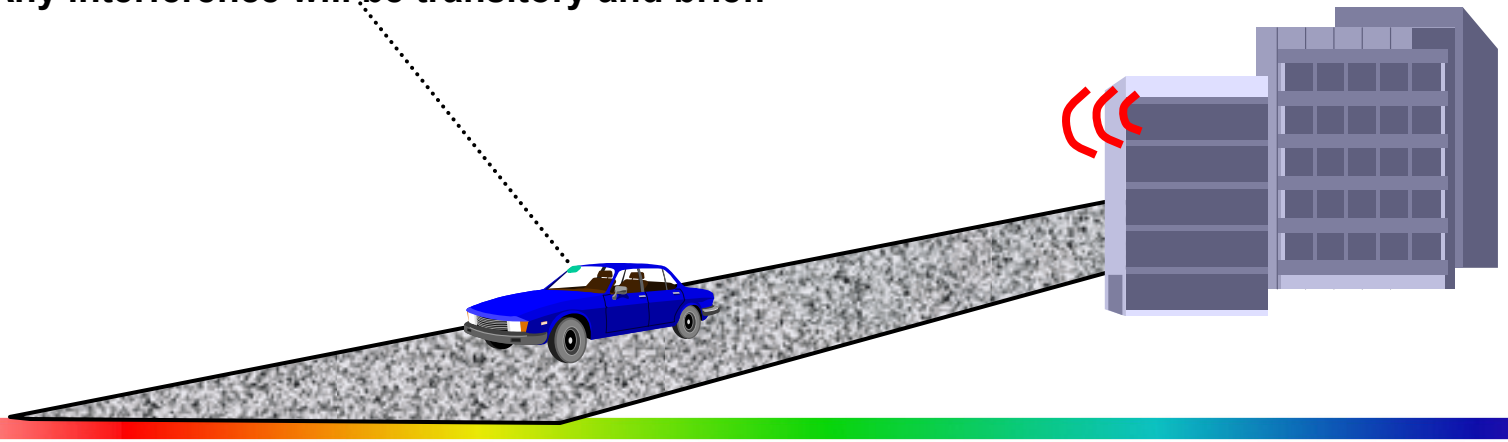


- **Key points on Qualcomm tests and analysis**
  - The analysis did not include 12 dB reduction below 2 GHz proposed by the NPRM.
  - The analysis assumes an unrealistic threshold for harmful interference (6 dB below the thermal noise).
  - Laboratory results presented by Qualcomm show that this threshold is too conservative by 6 to 16 dB.
  - The analysis assumes a perfectly quiet radio environment (disregards adjacent PCS cells, multipath, etc.).
- **Conclusions**
  - When Qualcomm results are re-examined in light of these specific points, the distance to potentially cause harmful interference drops to less than 2m.
  - This result is validated by the Sprint/TDS live tests where < 1.5 ft separation was required to observe any change in performance of a PCS radio.



The analysis shows that UWB operations using XSI's proposed changes will not lead to harmful interference

- **The DARS proponents have suggested that a level of 18μV/m @ 3 m be the limit of UWB below 3 GHz (28.8 dB below current Part 15 limits) in order to operate 1m from a UWB device.**
- **XSI's proposed changes provide >18 dB reduction to provide <5m separation distance**
  - XSI's spectral mask provides 6 dB of protection.
  - Linear to circular polarization loss is 3 dB
  - Building loss is >9 dB
  - Total of 18 dB additional loss or –59 dBm/MHz
  - These do not even include propagation losses, which DARS proponents also ignored.
- **But in most cases, the distance to the street provides adequate protection.**
- **Any interference will be transitory and brief.**



Summary of XSI Replies to the NTIA Studies

The analysis shows that UWB operations using XSI's proposed rule changes will not lead to harmful interference in any systems evaluated

- **The NTIA reports provided a good analytical framework but omitted many items to keep the analysis simple**
  - Older simple theoretical models of propagation instead of modern measurements-based models
  - Specific details concerning how victim systems operate, and how they are used and sited, for example:
    - Impossible geometries
    - Unrealistic interference thresholds
  - Effect of indoor usage restrictions on the UWB device's field propagation
  - Effect of spectral mask (NPRM or XSI's modification)

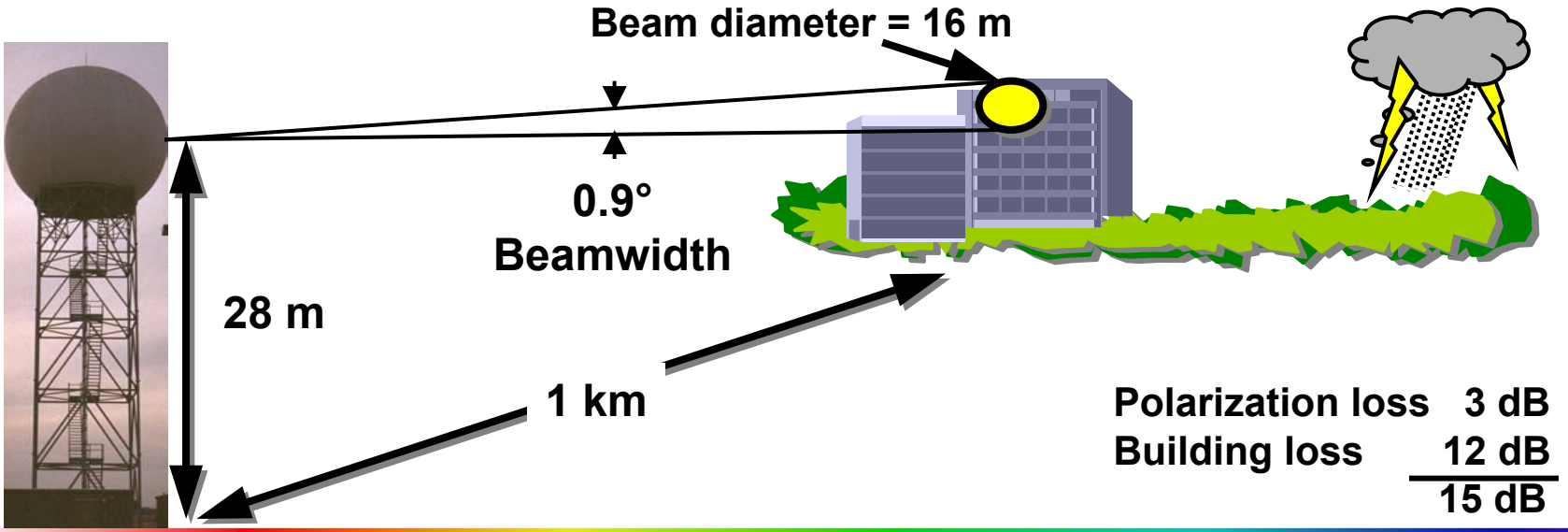
- **In its comment on the NTIA study, XSI incorporated the above items into the NTIA's analytical framework, and applied its proposed spectral mask**
  - Showed that the recommendations in the NTIA report were far too restrictive due to the simplifications used in the analysis,

NTIA Report on Non-GPS Systems

- The following slides point out key items added to analysis for each of the systems addressed in the report:
  - Ground-based Radar:
    - ARSR-4, ASR-9, NEXRAD, TDWR
  - Mobile Radar
    - Maritime Navigation Radar
  - Satellite Receivers:
    - FSS, SARSAT
  - Airborne Receivers:
    - ATCRBS, MLS, DME

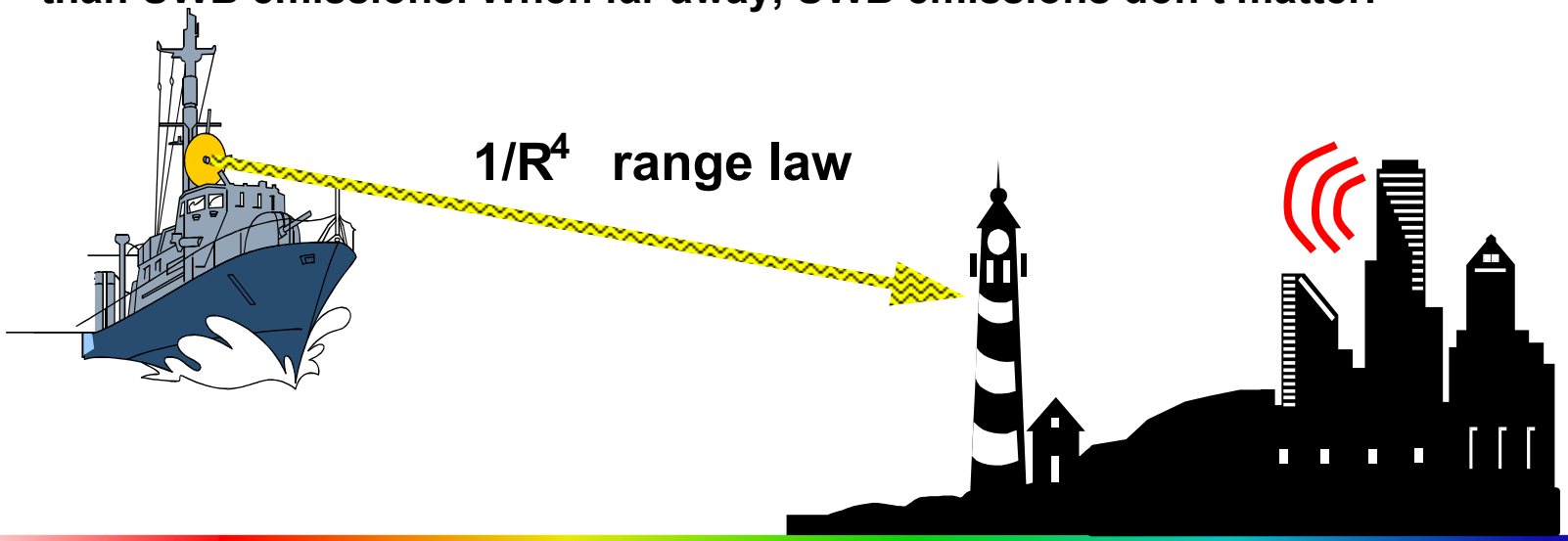
Ground-based Radar Example: NEXRAD Weather Radar

- **NTIA analysis showed 1 km was required separation distance**
- **BUT**
  - Geometry is unlikely due to site planning of radar system
  - The building itself is the reason for the degraded performance. The Radar cannot see an aircraft or weather behind the obstruction.
  - Ground radar beam width is only 0.9 degrees – 16m dia. at 1 km.
  - Unshielded UWB at 30 m height is unrealistic.
    Building loss (12 dB) must be in model since UWB device would be inside.
  - Polarization loss 3dB



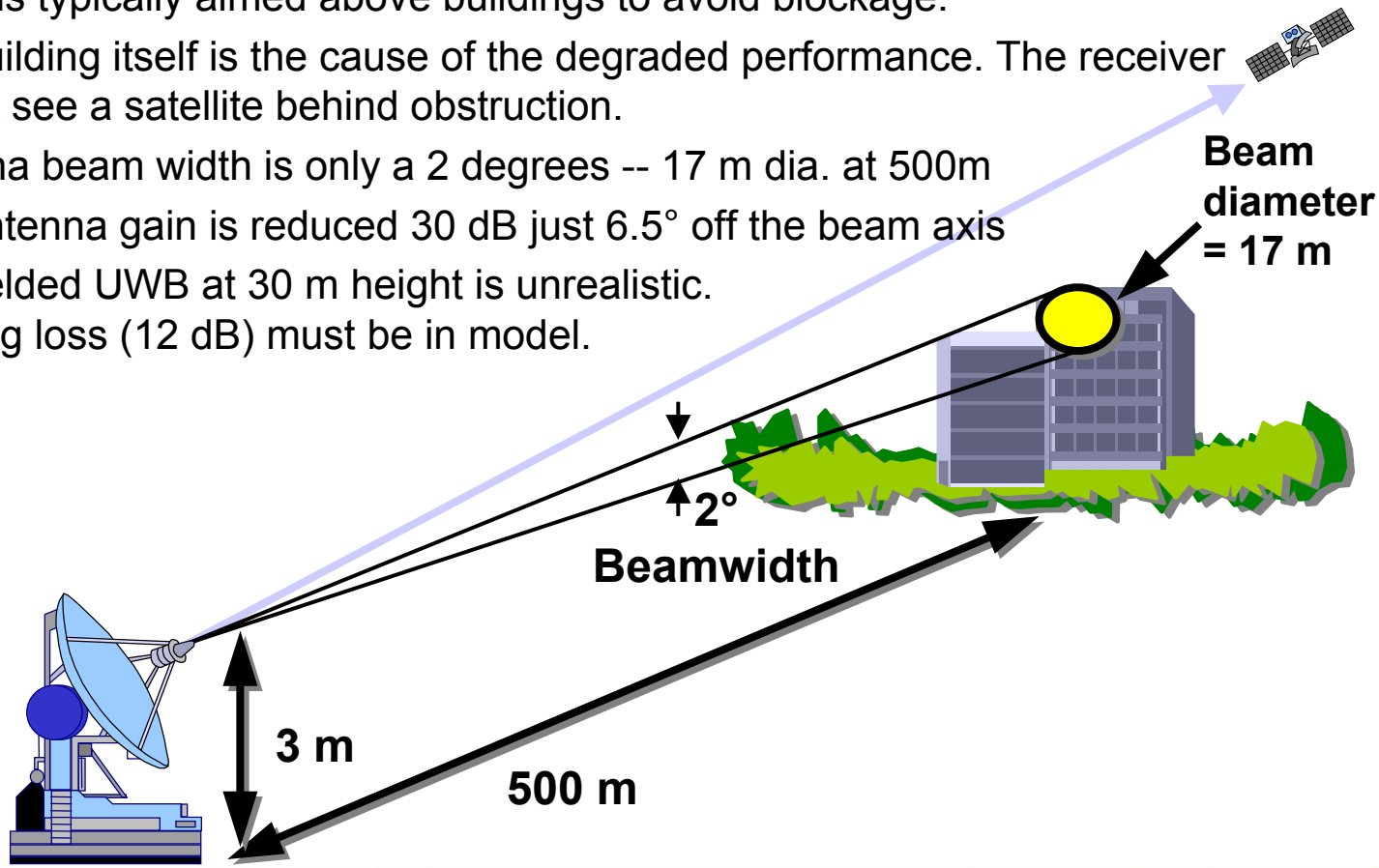
Maritime Navigation Radar
Operational factors neglected by NTIA analysis

- **NTIA showed that 1.2 km separation was required as antenna scanned toward land**
- **BUT –**
  - the analysis assumed that the radar was operating at maximum sensitivity in a clutter free environment
  - however, by 1.2km the radar return from the land is 84 dB stronger than the radar's noise floor (the radar is designed to pick up land mass at 160 km range)
  - When the antenna beam scans away from shore, the gain is reduced 25dB, placing UWB devices 10-16 dB below protection criterion.
- **BOTTOM LINE: When the ship is close, radar returns are much stronger than UWB emissions. When far away, UWB emissions don't matter.**



Satellite Receiver Example: Fixed Satellite Service Earth Station

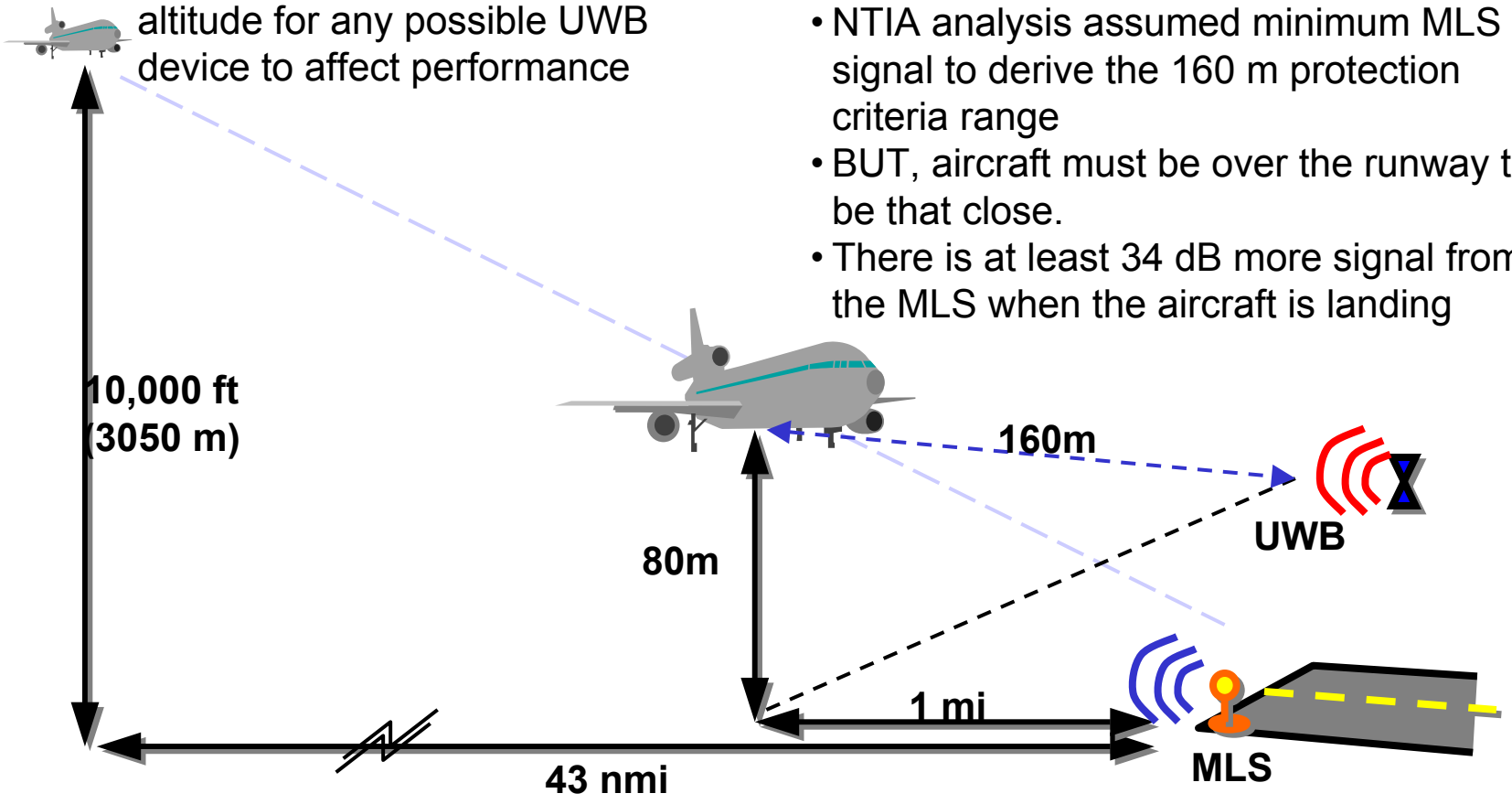
- **NTIA analysis showed that 500 m separation was required**
- **BUT**
  - Geometry is unlikely due to site planning of satellite ground station Beam is typically aimed above buildings to avoid blockage.
  - The building itself is the cause of the degraded performance. The receiver cannot see a satellite behind obstruction.
  - Antenna beam width is only a 2 degrees -- 17 m dia. at 500m
  - The antenna gain is reduced 30 dB just 6.5° off the beam axis
  - Unshielded UWB at 30 m height is unrealistic. Building loss (12 dB) must be in model.



Airborne Receiver Example: Microwave Landing System (MLS)

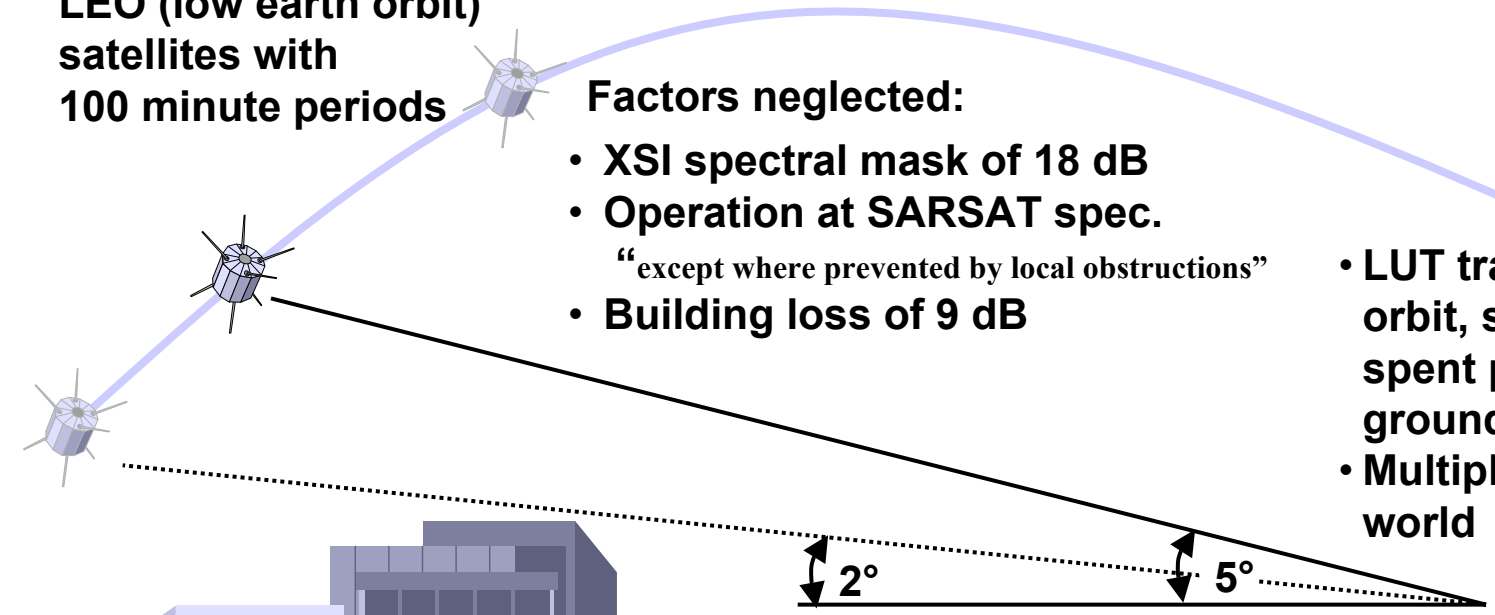
When the aircraft is at the maximum range (43 nautical mi) of the MLS (e.g. minimum MLS signal) the aircraft is at too great an altitude for any possible UWB device to affect performance

- NTIA analysis assumed minimum MLS signal to derive the 160 m protection criteria range
- BUT, aircraft must be over the runway to be that close.
- There is at least 34 dB more signal from the MLS when the aircraft is landing



Satellite Receiver Example: SARSAT Local User Terminal (LUT)

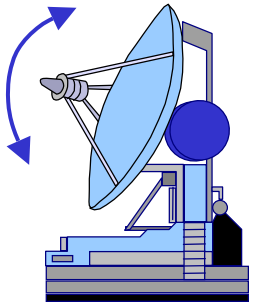
LEO (low earth orbit) satellites with 100 minute periods



Factors neglected:

- XSI spectral mask of 18 dB
- Operation at SARSAT spec.
  "except where prevented by local obstructions"
- Building loss of 9 dB

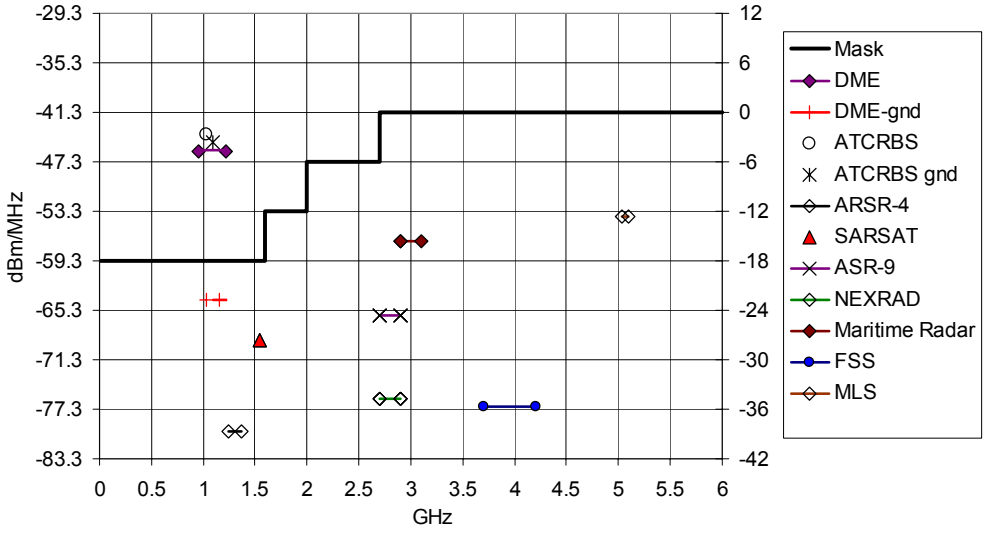
- LUT tracks SARSAT in orbit, so little time is spent pointing near the ground
- Multiple LUT's around world



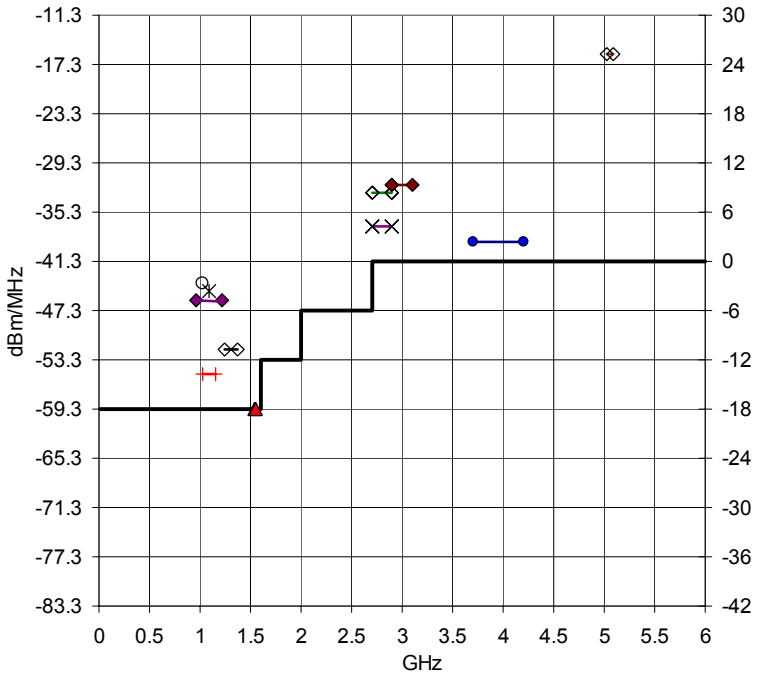
With proposed –59.3dBm/MHz limit protection criteria is not exceeded down to 200 m limit of ITM at 5° elevation.
By including 9 dB building loss, operation is possible even in the 2° elevation case.

Summary of Before & After Incorporating Items Left Out Of Analysis

- Simplified NTIA analysis versus XSI's proposed mask



- Same Analysis After including items omitted



- Factors included in extended analysis:
  - Realistic propagation losses, building penetration, antenna polarization, system usage.

Summary

- Analytical procedures used are accepted by the scientific community.
- Key commercial and government systems were tested and/or analyzed.
- In all cases, by applying the changes to the NPRM proposed by XSI, NO harmful interference was found.